

Let's Talk Water – Making a Well Measurement

By Dr. Mike Strobel

Originally, I planned to discuss streamflow measurements this week, but a number of people have asked about how to make a well measurement, so I thought I would cover this topic instead.

At the recent White Pine County Water Advisory Board meeting, there was a proposal to begin a citizen ground-water monitoring effort. This would involve local citizens making visits to wells throughout the county twice a year and measuring the ground-water levels. I believe there is an announcement concerning this effort that will be published in the newspaper in the near future.

Because people wish to be involved with making ground-water measurements, I thought it would be useful to discuss the basics of the process. For the data to be accurate and applicable to a large monitoring network, it needs to be collected in a proper fashion. The following are some of the key points:

Well selection: This is an important first step in putting a monitoring network together. Wells need to have good distribution so that a large area has adequate coverage and the wells are not all clustered into groups. Also important is that the various aquifers are represented.

For example, if in a certain valley there are 200 wells available for measurement. We would want to select some of these wells so that we had measurements throughout the valley (along the edges and near the center) and that are in the shallow alluvial aquifer and the deep bedrock aquifer.

If there were 10 wells within a single square mile and all in the alluvial aquifer, we probably wouldn't need to measure all of these because the information would be redundant. In this case, we would probably measure just one or two of the wells.

Besides location and aquifer type, also important in well selection is the effect of other impacts. For example, we probably wouldn't want to measure a well that is close to an irrigation well during the growing season. The drawdown caused by the irrigation well would affect the water levels in our observation well. This information could be useful if we are looking at impacts from pumping, but for a large-scale monitoring network, we typically are more interested in natural conditions, not pumping impacts.

There are hydrologists that can assist in the well selection process. It is important to consider which wells are being monitored by various agencies, so that any new monitoring network contributes to and compliments those efforts. And it's important to make sure that wells supply useful information and can be monitored for long periods of time (available for the next few years). Many wells have been monitored in the past as

part of other studies, and to select these wells and continue the monitoring would be useful information and a long period of record.

Well construction: It is really important to have information on the well construction. This is in the form of a drillers' log that is recorded at the time of well installation. The driller will record such information as the depth of the well, the length of the casing, the aquifer or geologic material in which the well is open, the length of the well screen or open interval, the type of well casing (steel pipe, PVC, etc.), pumping rate maintained following well installation, and other important information. Many land owners have the logs for their wells, but if not, these are filed with the State of Nevada and can be requested.

Well location: On the well log, the location of the well is provided (typically as either a location based on township, range, and section or in latitude and longitude). More recently, well locations are measured using GPS. Having an accurate well location is very important for the usefulness of the well in the monitoring network.

Making well measurements: Once wells have been selected, doing the actual measurements is relatively simple, but needs to follow a standard procedure. Before going into the field, make sure to have tools (wrench, pliers, etc.) to access some wells. Some observation wells are locked, so obtain keys ahead of time. Also, bring a well measuring tape, chalk, retractable tape measure (such as a carpenter's tape) and a log book to record measurements.

Water levels in wells are measured from the same spot each time. We call this the measuring point, and often it is marked with chalk on the top of the well casing. If there is not an established measuring point, then make the measurement from the north side of the well casing, mark this point with chalk, and record the location in your field notes.

In addition to recording the measuring point, it also is important to record the height of the measuring point above land surface. This is done by using the retractable tape measure and measuring from the measuring point to land at the base of the well.

Electric tape measurements: This is an electric tape, marked in tenths of feet, that is on a reel. The tapes typically are either 100 feet, 500 feet, or 1,000 feet in length. On the end of the tape is a metal probe that, when it encounters the water in the well, will sound a buzzer and a light will turn on. Once the top of the water is encountered, hold the tape to the measuring point and record the depth.

Steel tape measurements: A steel tape is similar to electric tapes in that there are increments marked on the tape and it is on a reel. The difference is that this requires a little math. You need to first mark the first 10 feet or so of the tape with chalk so that you can see the water mark easily. Lower the end of the tape into the well and continue until the tape goes into the water. Record the depth at the measuring point, then wind the tape back up out of the well. There will be a water mark on the tape, hopefully in the section previously chalked, that will show the depth to water. Record this number. Then, in the

log book, subtract the water mark from the measuring point to get true depth to the top of the water level.

For example, let's say that the tape is lowered and held at the measuring point at 50.0 feet. The water mark on the tape is at 3.4 feet. This indicates that the depth to water is 46.6 feet below the measuring point. If the measuring point is 2 feet above land surface, then the water in this well is 44.6 feet below land surface.

That is pretty much all there is to making a measurement. Please remember to record where the well is located, the date and time of measurement, and any other observations, such as if there is an irrigation well pumping nearby or if the well is near standing water, etc. These notes prove to be very useful later when evaluating water levels over time.

Once you leave a site, make sure the well is secured (capped and locked), that you have all your tools and equipment, and that all gates and other access are closed behind you. Property owners are much more cooperative when you show respect for their well and land.

There will be some upcoming training sessions on making well measurements (look for announcements in this paper), during which all of this will be demonstrated. Once you do it a few times, it becomes an easy process to remember.

I hope this provides a general overview on how to measure a well. If you have any questions, please let me know either through the Ely Times or email me at mstrobel@usgs.gov. Next week, we will discuss how streamflow measurements are collected.